

## Prospects of Problem-Based Learning in Building Critical Thinking Skills among Technical College Students in Nigeria

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### Abstract

*Critical-thinking skills (CTS) are among the essential skills required in the contemporary world of work. However, building CTS among technical college students in Nigeria is making little impact on students as current teaching uses is "traditional" rote learning methods which do not foster the building of skills. Therefore, a new teaching method is required that emphasizes learning, understanding, and measuring skills rather than rote learning. Educators unanimously agree that, CTS can be taught using different teaching methods including concept mapping, critical questioning workshops, and systematic literature reviews and to problem based learning (PBL). PBL is a student-centered, task-based instructional method in which the teacher serves as a facilitator. The paper adapted a library based work; the data were collected using textbooks, journals articles and internet search. The literatures reveal that; PBL is the best approach to build CTS, integrating it into all areas of learnings and to the student's entire life. In PBL, students demonstrate an enhanced ability to use CTS in their activities. Against this backdrop, the paper aim to outline the impact of PBL in building CTS among the technical colleges students. The paper recommends that, for the purpose of filling the CTS gap, technical colleges should equip their students with the required skills through the application of a superior teaching method such as PBL.*

**Keywords:** Problem-Based Learning, Critical Thinking Skills, Technical College, Learning

### 1. Introduction

Technical colleges in Nigeria were purposely opened to train people to acquired and mastered knowledge and skills for their formal daily use (Edu, Ayang, & Idaka, 2012) and also to meet country's employment needs of middle and medium manpower, but unfortunately, it is noted that the preparation of workers for today's industries in Nigeria is ineffective leading to high unemployment rate of TVET graduates together with short fall of human resources (Udofia, Ekpo, Nsa, & Akpan, 2012; Uwaifo, 2009).

The world is rapidly changing and the growth of different occupations and enormous demands for high-skilled workers that make a four-year degree less valuable for gaining employment. In line with this, essential skills such as CTS need to be developed among students to prepare them for future careers such as technicians, engineers, and leaders (Beyth-Marom, Novik, & Sloan, 1987; Masek, 2012). According to Q. Zhou, Huang, and Tian (2013), CTS are such an integral part of modern education that one cannot be separated from the other. CTS are an indispensable instrument in modern society, enables students to effectively face the challenges in building new ideas, making correct selections, and understanding the world around them (Miri, David, & Uri, 2007; Shakirova, 2007; Snyder & Snyder, 2008; ZOLLER, 2001; Zoller & Pushkin, 2007). Furthermore, Snyder and Snyder (2008) posits that, CTS are learned skills and a product of education, training and practice that must be developed, practiced; and constantly integrated into the curriculum in order to engage students in active learning.

Employers today are focused on how to recruit better workers who possess not only technical (hard) skills, but also have critical thinking, problem solving, decision making and good reasoning skills among others (Audu, Kamin, Musta'amal, Saud, & Hamid, 2014). To overcome these challenges, Miri et al. (2007); and Zoller et al. (2000) suggested that, CTS should be integrated into the students' training in order to serve as a catalyst toward the analysis of unfamiliar

situations, where-by their methods of asking questions, problem-solving and decision-making capabilities will centered on a framework of rational thinking. Essential skill such as CTS can best be learned and taught in schools using active teaching methods (Awang & Ramly, 2008; Profetto-McGrath, 2005).

The learners' lifelong needs and development of CTS cannot be met by traditional methods of teaching; therefore, there is a need for a shift from teacher-centered methods to more learner-centered methods that are designed to increase learners' engagement and learning participation. Accordingly, in the present-day development of the pedagogical approach, one new method that has been claimed to promote students' critical-thinking ability is the use of PBL (Masek, 2012). Therefore, moving to PBL as new learning and teaching approach is seen as a possible solution to this problem. The literature reveals that; PBL is effective in targeted learning domains, such as knowledge acquisition (Bilgin, Senocak, & Sozibilir, 2009; Dehkordi & Heydarnejad, 2008b), critical-thinking ability (Şendağ & Odabaşı, 2009), and motivation (Martin, West, & Bill, 2008). Many researchers have highlighted that; PBL can also promote deep approaches to learning instead of surface approaches and thereby increase institutional benefits (Biggs, 2003); improve active learning (De Graaff & Cowdroy, 1997; Du, 2006); develops the criticality of learners (Savin-Baden, 2003); improve self-directed learning capability (Du, 2006; Hmelo & Evensen, 2000); increase the consideration of interdisciplinary knowledge and skills (De Graaf & Kolmos, 2003; Kjærdsdam, 1994); it develops management, collaboration and communication skills (Du, 2006; Kolmos, 1996, 1999, 2002); it develops professional identity and responsibility development (Du, 2006; Evensen & Hmelo-Silver, 2000; Hmelo & Evensen, 2000; Kolmos, 2010); and improve the meaningfulness of learning (Du, 2006; Savin-Baden, 2000).

In addition, PBL enables students to develop and refine higher-order thinking skills, problem-solving skills, creative and critical-thinking, leadership skills and self-regulated learning habits, all of which are necessary qualities for effective performance in today's business world (Awang & Ramly, 2008; Major & Palmer, 2001; Savery, 2015; Savery et al., 2006). According to Ali (2010); Mansur, Kayastha, Makaju, and Dongol (2014); and Morales-Mann and Kaitell (2001) when students went through the PBL approach they developed the skills needed by contemporary employers. The ultimate goals of the PBL approach, according to Hearn and Hopper, (2008), is to foster the development of CTS through problem solving.

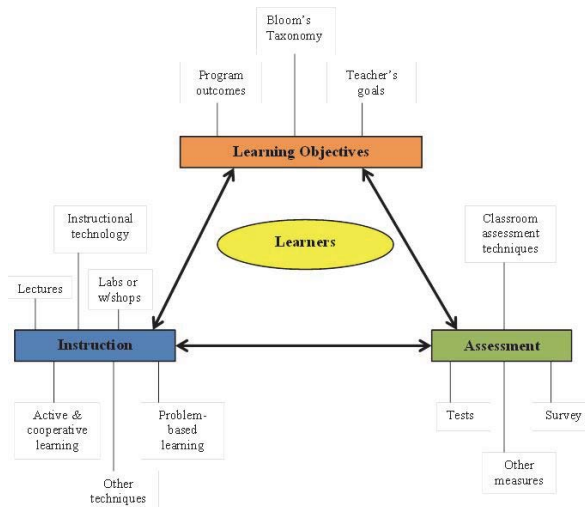
## **2. Concept of Problem Based Learning and it is Effectiveness in Teaching and Learning**

PBL starts once students are challenged with an open-ended, ill-structured, authentic (real-world) problem and work in groups to classify learning needs and develop a possible answer, with teachers saved as guide rather than a leader (Prince & Felder, 2006, 2009; Vikas Shinde & Inamdar, 2014). According to Myers (2008) PBL is an instructional (and curricular) learner- centered approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem. PBL is also one of the active teaching methods popularly known as the "student-centered" method which has been embraced by a number of institutions of higher learning across the globe as a method of delivery including Denmark, Canada, Australia, and Singapore (L. Brodie & Gibbins, 2007; Kolmos et al., 2007; J. Wang, Fong, & Alwis, 2005). PBL has been used in different educational disciplines, including chemical engineering (Xiuping, 2002; Zhang, 2002), electronic engineering (Mantri, 2014; Mantri, Dutt, Gupta, & Chitkara, 2009), electrical engineering (Noordin, Nasir, Ali, & Nordin, 2011), engineering and surveying (L. Brodie & Gibbins, 2007), science education (K. K. H. Wong & Day, 2009), mathematics (Bottge, Rueda, LaRoque, Serlin, & Kwon, 2007), business and entrepreneurs (Mossuto, 2009), as well as agriculture (Anderson, 2007; Burris & Garton, 2007).

The PBL approach involves important, contextualised, real-world answers and providing resources, guidance, and instruction to learners as they develop content knowledge and problem-solving skills (Mossuto, 2009). Duch, Groh, and Allen (2001b); Duch, Groh, and Allen (2001a) claim that; PBL is a pedagogical strategy that challenges students to 'learn to learn', as they are working cooperatively in a small groups to find answers to real-world problems. It is generally accepted that PBL makes students to think critically and analytically, and also to seek and use suitable learning resources (Duch et al., 2001a, 2001b). Researches were conducted around the globe in all aspects of educational endeavours to ascertain the effectiveness of PBL in building skills among learners (Barsky, Catanach Jr, & Stout, 2002; Braun, 2004; P. Brodie & Irving, 2007; Celuch & Slama, 1999; Gürses, Açıkıldız, Doğar, & Sözbilir, 2007; Kumar & Natarajan, 2007; Masek & Yamin, 2012; Saraoglu, Yobaccio, & Louton, 2000; Snyder & Snyder, 2008), and all the results demonstrate were in favour of effectiveness PBL in CTS building.

The literature reviewed for this article, it reveals that good PBL approaches requires effort in three domains: planning (identifying course content and defining measurable learning objectives for it); instruction (selecting and implementing the methods that will be used to deliver the specified content and facilitate learner achievement of the

objectives); and assessment and evaluation (selecting and implementing the methods that will be used to determine whether and how well the objectives have been achieved and interpreting the results) (Felder & Brent, 2003). These domains are illustrated in figure 1.



**Figure 1:** Elements of PBL course design

**Source:** (Felder & Brent, 2003)

### 3. Concept of Critical Thinking

Critical thinking is a purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as an explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based (Mulnix, 2012; Stewart, Cartier, & Passmore, 2005; Q. Zhou et al., 2013). Similarly, critical thinking is seen as a process of evaluating evidence for certain claims, determining whether presented conclusions logically follow from the evidence, and considering alternative explanations (Fani, 2011). Accordingly, critical thinking will make students move "sideways" to try different perceptions, different concepts, and different points of entry (Awang & Ramly, 2008).

Furthermore, critical thinking is viewed as one of the higher cognitive abilities, besides creative thinking, problem-solving, and decision-making (Colucciello, 1999; Daley, Shaw, Balistrieri, Glasenapp, & Piacentine, 1999). Bailin and Siegel (2003); Bailin (2002); and Bailin (1987) posits that critical and creative thinking are closely linked and incorporated in producing effective thinking and problem-solving capabilities.

Learning and teaching higher-order cognitive abilities such as critical thinking has continuously been the ultimate goal of education (Spendlove, 2008), specifically in technology and engineering education. Paul and Scriven (2007), are of the opinion that critical thinking is similar to the scientific method; in that it is a methodical and technical means to understand and teach the process of thinking. Just as students learn the process of the scientific method, they must also learn the process of thinking critically. With the current development in manufacturing industries, building CTS among technical vocational education and training (TVET) students has become an imperative, if we want to have capable engineers for tomorrow (Norris, 1985, 1989); teaching CTS is believed to be as significant as educating a person (Masek & Yamin, 2012).

### 4. The Need to Build Critical Thinking Skills among Technical College Students in Nigeria

Evidence from research has shown that there is the need to develop CTS among students world over. This is because many of them are not using sophisticated reasoning to solve problems even at the college level (Halpern, 1998, 1999, 2002; Kuhn, 1999, 2000; Marin & Halpern, 2011; Miri et al., 2007; Ten Dam & Volman, 2004; YILMAZ, 2013). It is

unanimously accepted that CTS is becoming an important tool and key to success in modern societies, the world is developing rapidly, becoming more sophisticated in terms of IT and interdependencies continues to strengthen. Therefore, more critical thinkers are needed to make coherent decisions based-on evaluative and critical thinking rather than acceptance of precedent and authority (Beyth-Marom et al., 1987; Marin & Halpern, 2011; Snyder & Snyder, 2008). In the modern societies, people are expected to take responsibility and improve their own conditions rather than knowing their place (Ten Dam & Volman, 2004).

In the Nigerian context, the literature reveals a worrisome situation (Egbo, 2011) in which Nigerian students are completely absent in international examinations like "Trends in International Mathematics and Science Study" and "Progress in Reading Literacy Study". This further signifies that, Nigerian students are not receiving the type of education that will prepare them for life in a competitive world that demands innovation, creativity and critical thinking. In addition, the quality of technical college graduates has been a major source of concern among most employers in the Nigerian labour market, who have expressed their dissatisfaction regarding the level of technical and essential skills possessed by the graduates (Inti, Latib, & Rufai; Isah Usman, Celement, & Raihan, 2013; Udofia et al., 2012). It is also reported in Nigeria that most of the TVET graduates do not perform well in jobs interviews because they only have general and theoretical knowledge that does little to prepare them for the actual tasks or skills they will encounter in their jobs (Isah Usman et al., 2013; Udofia et al., 2012; Umunadi, 2012), while most companies are looking for TVET graduates with skills beyond the standard paper degree (Agus, Awang, Yussof, & Mohamed Makhbul, 2011; Beder, 2000; A. L. Brown & Campione, 2002; Daud, 2013; Goddard, 2002; Goolo & Augar, 2009; Isah Usman et al., 2013; Ismail, Yussof, & Sieng, 2011; Young & Chapman, 2010).

The trend in the methods of teaching TVET programs in Nigerian technical and vocational colleges is still "traditional" and these are the kinds of methods which tend to hinder trainees from acquiring effective skills that make them to be self-reliant or employable (Akpomi, 2009; Eke, 2011; Garba, 2010; Kennedy, 2011). This explains why youth unemployment in Nigeria, appears to be increasing quickly, because many of them lack employability skills such as CTS. Even though, CTS is among those skills that are supposed to be acquired from technical colleges (Onu, 2013). The poverty level in Nigeria is 70% despite TVET (Adebayo, 2013; Ajufo, 2013; Margwa, Onu, Jalo, & Dire, 2015). Report shows that in 2003, primary school graduates accounted for 14.7% of unemployment, secondary school graduates constituted 53.6%, and tertiary schools graduates constituted 12.4%. In 2003, the nation's poverty levels were put at 70% and more than 91 million Nigerians are said to live on less than one dollar per day (Ajufo, 2013).

Most analysts agree that contemporary employers demand more skilled workers than they did in the past (Behar-Horenstein & Niu, 2011; Bowell & Kingsbury, 2013; Twiname & Gibb, 2012). Therefore, building CTS among Nigeria's TVET students cannot be overemphasized. According to (Angelo, 1995) and (Duron, Limbach, & Waugh, 2006) it is importance build CTS among TVET students in order to develop and improve the students'

- Ability to work productively with others,
- management skills, leadership skills,
- a commitment to accurate work,
- ability to follow directions,
- instructions, and plans,
- ability to organize and use time effectively,
- a commitment to personal achievement, and ability to perform skillfully.

In addition, Q. Wang, Woo, and Zhao (2009); C. Zhou (2012); and Kerka (1992) agreed that CTS is needed to be in cooperated into TVET training because, in this new knowledge era, the industries contains more complicated and sophisticated high-tech equipment and computerized systems, which create more complex problems that are more reliant on cognitive capabilities to solve. Therefore, it becomes crucial for career and technology educators to be more pragmatic, resourceful, creative, and flexible in their curriculum and delivery approaches if they are to provide students with the critical thinking and problem- solving skills they require in order to compete successfully for jobs in both the national and international work arenas (D. F. Brown, 2006).

## **5. Problem-Based Learning and the Building of Critical Thinking Skills**

In a wider educational context, the number of studies that reported PBL as being less effective (Cinar & Bayraktar, 2014; Matthews, 2004) is fairly equal to the number of studies reporting PBL provides a more effective construction of learners' knowledge acquisition of procedures or applications (Capon & Kuhn, 2004; Dehkordi & Heydarnejad, 2008a; Kasai, Sugimoto, & Uchiyama, 2006; Pease & Kuhn, 2011). When compared to Bloom's taxonomy of the cognitive domain, PBL

appears to be effective in promoting learning at a higher cognitive level for application and evaluation, but not at the understanding level (Alcázar & Fitzgerald, 2005; Dehkordi & Heydarnejad, 2008a). Relating PBL to higher order thinking skill components, several studies that are related to PBL and CTS have showed positive outcomes (Atkinson, Derry, Renkl, & Wortham, 2000; Iwaoka, Li, & Rhee, 2010; Tiwari, Lai, So, & Yuen, 2006). Moreover, (V Shinde, 2011; V. V. Shinde & Inamdar, 2013) reported that PBL could be a suitable option for acquiring the skills needed by the industries. The result of that study mapped out PBL outcomes with skills gaps among Indian engineering graduates as requested by the industries. Table 1.1 summarizes the skills that can be achieved by learners in a PBL setting according to (V Shinde, 2011). The 'X' indicates that the skills can be achieved in the PBL environment.

**Table 1.1:** Alignment of skills demanded by employers and PBL learning outcomes

| Core Employability Skills gaps | Learning outcomes achievable by PBL | Professional Skills gaps | Learning outcomes achievable by PBL | Communication Skills gaps | Learning outcomes achievable by PBL |
|--------------------------------|-------------------------------------|--------------------------|-------------------------------------|---------------------------|-------------------------------------|
| Reliability                    |                                     | Problem solving          | X                                   | Experiments/data analysis | X                                   |
| Self-motivated                 | X                                   | Creativity               | X                                   | Reading                   | X                                   |
| Willingness to learn           | X                                   | Use of modern tools      | X                                   | Technical Skills          | X                                   |
| Understand/take directions     |                                     | System design to needs   |                                     | Written Communication     | X                                   |
| Integrity                      |                                     | Contemporary issues      | X                                   | Verbal Communication      | X                                   |
| Teamwork                       | X                                   | Apply Math/Sci/Engg know |                                     | Advanced Computer         | X                                   |
| Entrepreneurship               |                                     | Customer Service         |                                     | Basic Computer            | X                                   |
| Self-discipline                | X                                   |                          |                                     | Communication in English  | X                                   |
| Flexibility                    |                                     |                          |                                     |                           |                                     |
| Empathy                        | X                                   |                          |                                     |                           |                                     |

**Source:** (V Shinde, 2011)

From the table it can be seen that the PBL approach, most of the skills needed by the employers can be achieved. This in turn can help to bridge the gap between employers' expectations and learning achieved at the technical institutes.

However, several studies also revealed negative outcomes, showing no significant difference from the two comparison groups, when investigating the effects of PBL on CT (Al Huthali, 2014; Ansari, Rahman, Badgujar, Sami, & Abdullah, 2015; Hung, Jonassen, & Liu, 2008; Mohammed Lame, Yusoff, & Fauziah, 2013) reported that there is no significant differences between the compared groups involved. Furthermore, most of the studies on CT were conducted in the field of mathematics (Bahar, 2013; Chiu, 2009; Leikin, 2009). The studies that investigated the correlation between PBL and CT across disciplines and populations were insufficient (Tan, Chye, & Teo, 2009; C. Zhou, 2012).

Though from the literature review, some research recorded negative results of either no significant difference or no difference at all between the study groups when researching the effectiveness of PBL on CTS building. Yet there is much other research that reported positive impact of PBL on the building of CTS which shows that the chances of PBL approach in building CTS among TVET students is higher if properly implemented. This is because, from the literature synthesis, it can be established that the PBL environment is favourable to improving students' cognitive skills. The PBL approach has been recognized as an active agent in developing students' technical or cognitive skills like problem-solving, critical and creative thinking and application of knowledge, as well as process skills like project and time management, teamwork and leadership, written and oral language. Linking these results with Nigerian industries' needed essential skills, the importance of PBL for the Nigerian situation could be recognized. This is supported by Snyder and Snyder (2008); Duplass and Ziedler (2002); Hemming (2000); and M. S. Wong (2007), who stated that PBL should be used to develop CTS into the students.

## 6. Conclusion

In the present economy, where knowledge, information, customer service, innovation and high performance are the top priorities, the possession of CTS is becoming indispensable in order to gain employment and make career progression.

Today's TVET students need to have diversity of skills that provide flexibility for them to be adaptable in the workforce. And in order to meet with these requirements, students would need "a firm institution of knowledge, skills and understanding. These are the skills that can be developed throughout each individual's lifetime and can be acquired at colleges through students' participation in the teaching and learning processes such as through the PBL approach.

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